announced purpose. For example, the "circulation" of the sap is repeatedly described and impressed by a diagram with arrows showing the direction of the "ascending sap" and the "descending sap." The "osmotic force" is presented as "une nouvelle force," residing in the protoplasm in virtue of which it exercises "une puissante attraction." Many other similar cases might be cited from all sections.

The best thing about the book is the illustrations, most of which are excellent. But as a whole it can hardly be commended.—C. R. B.

A NEW PART (second series, Part IV) of the *Minnesota Botanical Studies* has appeared, bearing the date August 15, 1900. It contains seven papers of varying length, and is altogether a worthy member of the series. "A contribution to the knowledge of the flora of southeastern Minnesota," by W. A. Wheeler, is in the nature of a report of the work of the State Botanical Survey during the summer of 1899, and the results are presented with a well-organized ecological background, accompanied by seven excellent plates from photographs showing characteristic vegetation features. "The seed and seedling of the western larkspur (*Delphinium occidentale*)," by Francis Ramaley, is a brief morphological and histological study, illustrated by a plate. "A preliminary list of Minnesota Erysipheæ," by E. M. Freeman, catalogues nineteen species, with their hosts. K. C. Davis publishes three important revisions which have been developed in connection with the work on Professor L. H. Bailey's *Cyclopedia of American Horticulture*. They are as follows: "Native and garden Delphiniums of North America," 52 species being described, one of which is new; "Native and cultivated Ranunculi of North America and segregated genera," the genera being *Batrachium* S. F. Gray (5 spp.), *Ranunculus* L. (96 spp., two new), *Kumlienia* Greene (1 sp.), *Ficaria* Huds. (1 sp.), *Cyrtorhyncha* Nutt. (1 sp.), *Arcteranthis* Greene (1 sp.), and *Oxygraphis* Bunge (1 sp.); "A synonymic conspectus of the native and garden Thalictrums of North America," 35 species being described. The final paper is entitled "Some preliminary observations on *Dictyophora ravenelii* Burt," by C. S. Scofield, accompanied by three excellent plates, and among the conclusions reached the following is of general interest: "There is in the young mycelial threads very good evidence of the occurrence of cell fusion previous to, or in intimate connection with, the formation of the sporophore."—J. M. C.

NOTES FOR STUDENTS.

NAWASCHIN[41] has recently made a cytological study of *Plasmodiophora brassicae* Woron. Plasmodiophora is a parasitic myxomycete which causes various deformities and distortions in the roots of its host. *P. brassicae* is

[14] Beobachtungen über den feineren Bau und Umwandlung von *Plasmodiophora Brassicae* Woron. im Laufe ihres intracellularen Lebens. Fora 86: 404–427. pl. 20. 1899.

the cause of "club root" in cabbages and turnips. Woronin, who studied this form more than twenty years ago, found that it does not form sporangia, but that the spore masses lie free in the cells of the host. Eycleshymer, in *Jour. Mycol.* 7:79–88. 1892, gives a clear account of its life history and distribution in the United States. The present paper is concerned with the more minute details. Infected roots were cut into very small pieces and were treated with Flemming's stronger solution for twenty-four hours. The author thinks that the advantages of a more prolonged treatment are entirely imaginary. Sections were cut 2–3 μ in thickness, and were fastened to the slide with distilled water without any further fixative. The Flemming triple stain gave the best results. Dilute Delafield's haematoxylin, followed by eosin in clove oil, and also the gentian-violet method according to Gram, gave good results. The peculiar method of nuclear division in the vegetative amoebae is worthy of special mention. In the resting condition this nucleus has a membrane, a nucleolus, and an extremely delicate chromatin network. As division begins, clearly differentiated chromatin granules appear in the place of the network, the granules having no genetic connection with the nucleolus. A plate evidently derived from the chromatin granules is then seen near the nucleolus. At this stage there is a sort of one-sided "achromatic figure" with its base resting upon the chromatin plate and its apex at the nuclear membrane, but the figure afterward acquires a symmetrical aspect, the drawings in the plate bearing considerable resemblance to bipolar spindles. The nucleolus then divides transversely, and the two resulting bodies take positions on opposite sides of the chromatin plate, which is now a homogeneous disk with chromatin granules imbedded in its periphery. The chromatin plate then splits, and the two parts, each accompanied by a nucleolus, move toward the poles of the spindle, and two daughter nuclei are formed. This method of division is of greater interest because the nuclear division in the plasmodium is simultaneous and of the usual bipolar mitotic type. The author's summary of the entire paper is about as follows:

1. The group of infected cells arises by the repeated division of a primary infected cell.

2. During the growth of the infected cells numerous multinucleate amoebae appear, which multiply without fusing to form a plasmodium.

3. In this condition the amoebae of Plasmodiophora are remarkable for their structure, and especially for their unique mode of nuclear division.

4. The mode of nutrition of the amoebae seems to be different from that in other Myxomycetes.

5. As the amoebae fuse into a plasmodium, characteristic changes take place in the structure of the body and in the nuclei.

6. The formation of a plasmodium takes place only after the host cell is exhausted.

7. In the mature plasmodium spore formation is preceded by repeated nuclear division of the typical mitotic sort.

8. In the first period of its development the parasite does not kill the host cell, but merely causes it to hypertrophy.—CHARLES J. CHAMBERLAIN.

HERBERT J. WEBBER, who has long been investigating the subject of plant-breeding for the Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture, has published [15] his results upon xenia in maize, which means the immediate effect of pollen upon structures outside of the embryo. His experiments are by no means complete, but they have already yielded suggestive results, and the author is justified in their publication by the fact that the subject has been brought under discussion by the discovery of double fertilization, and its application by de Vries and Correns to the explanation of xenia. Mr. Webber had already reached the same conclusion independently, and was collecting a large amount of experimental data to substantiate his more leisurely developing paper.

It seems that the name "xenia" was applied to this phenomenon by Focke.[16] While it is claimed to be a somewhat common phenomenon in many plants, there are very few cases on record that are not open to doubt, and in no plant is its occurrence so well substantiated as in maize. The experiments of Mr. Webber have been conducted since 1898, in Washington and at the Nebraska Agricultural Experiment Station. The greatest care was used to obtain pure races and to prevent the access of foreign pollen. Full details are given of about thirty experiments which yielded pertinent results, and the paper closes with their discussion.

The author abundantly confirmed Körnicke's statement that xenia is shown only in the endosperm. Color in the endosperm is frequently transmitted by the pollinating parent, but color in the pericarp is not. The chemical composition of the endosperm is also greatly affected by the pollinating parent, sweet corn crossed with dent or flint races producing smooth grains with starchy endosperm, and *vice versa*. All of the experiments favor the theory that xenia in maize is caused by the fertilization of the endosperm nucleus by one of the male cells. All of the grains showing xenia proved to be true hybrids. In the case of spotted grains the author proposes an interesting hypothesis by way of explanation. He suggests that the male nucleus may fail to fuse with the polar nuclei, and in such a case may be able to form a spindle and divide separately. In this event two races of free nuclei would be formed, and when the parietal placing and tissue formation begin, the two races might become intermixed. A second hypothesis explaining this phenomenon suggests that the male cell fuses with but one of the polar nuclei,

[15] Xenia, or the immediate effect of pollen, in maize. Bulletin 22, with four plates (one colored). Issued September 12, 1900.'

[16] Die Pflanzen-Mischlinge 511. 1881.

the other polar nucleus dividing independently. This also would result in two races of nuclei which might become more or less intermixed before fixation in a tissue.

We await with expectation the minute investigation of the structures concerned, which should settle the question of double fertilization for maize.—J. M. C.

THE POWER of the infusoria to adjust themselves to certain changes in their nutrient medium is the subject of a paper by Atsushi Yasuda.[17] From a nutrient fluid in which they were growing normally, the infusoria were transferred to solutions of the following substances: saccharose, glucose, lactose, glycerin, KNO_3, $NaNO_3$, $MgSO_4$, KCl, NaCl, and NH_4Cl, in varying concentration. The organisms used for the experiments were *Euglena viridis*, *Chilomonas paramœcium*, *Mallomonas Plasslii*, *Colpidium colpoda*, and *Paramœcium candatum*. In general, excepting Euglena, these can withstand about 6 per cent. of glucose, while Euglena withstands 11 per cent. With the other sugars the ratio is nearly the same, but with glycerin it is about $\frac{4}{6}$ instead of $\frac{6}{11}$, as above. In the case of the electrolytes it is still greater, usually however less than unity. *Aspergillus niger* withstands over 50 per cent. of glucose and 21 per cent of $NaNO_3$ (Eschenhagen), and Zygnema adapts itself to 50 per cent. of saccharose and 20 per cent. of glycerin (Klebs). Thus we see that in this respect Euglena stands intermediate between the other organisms here studied and the lower algæ and fungi, studied by Eschenhagen, Klebs, and Richter. This may be of interest to those attempting to decide the question of the animal or plant nature of Euglena.

If we use De Vries' coefficients for comparing osmotic pressures, the solutions at the limit of adaptability are, in a very general way, nearly isosmotic. The fact that in the author's results there are many very pronounced exceptions to this statement is not to be wondered at, since he has not only subjected the organism to a strong solution of the substance to be tested, but has also deprived it of its proper food supply. This, it would appear, is a very weak point in all such experimentation as the present. All these results were obtained when the infusoria must have been in an unhealthy condition. In general, the limit to the adjusting power seems to be of an osmotic nature. When the organism is first placed in one of these strong solutions its membrane becomes wrinkled, owing, doubtless, to extraction of water. Later these folds disappear; this is apparently the effect of an osmotic change in the protoplasm, adapting itself to the new conditions. The more concentrated the solution becomes, the more rounded is the form of the organism, and its outline becomes uneven.—BURTON EDWARD LIVINGSTON.

[17] Studien über die Anpassungsfähigkeit einiger Infusorien an concentrirte Lösungen. Jour. Coll. Sci. Imp. Univ. Tōkyō **13**: 101–140. *pls. 10–12.* 1900.

DR. TH. BOKORNY discusses [18] the various modes of storage of proteids and their microchemical relations. Proteids soluble in 5–10 per cent. salt solution (globulin) are stored in the proteid grains and crystals ("aleurone" and "crystalloids") of seeds. Proteids insoluble in NaCl solution have not been observed in proteid grains. Neither "active proteid" nor fat could be detected in the proteid grain itself; the fat is associated with the general proteids of the seed, probably with the plasmatic proteids. The plant caseins seem not to occur in the proteid grains, for these dissolve completely in NaCl solution, whereas the caseins are not soluble therein. The glutens of the cereals constitute a special case; they dissolve in 70–80 per cent. alcohol, a fluid which usually serves to precipitate proteids. Peptone was not recognizable in resting seeds. It and peptonizing enzymes occur in plants only exceptionally, as in fungi and carnivorous plants. Simple amides (asparagin, tyrosin, leucin, etc.) are well known in seeds and are widely distributed in vegetative parts. They appear to be the first decomposition product as well as the first formative stage of the proteids.— C. R. B.

L. KNY has been unable to find any traces of the intercellular living protoplasm said by Baranetzki to be observable in the intercellular spaces of young stems of *Myriophyllum spicatum* and *Ceratophyllum demersum*, and in young petioles of *Nuphar luteum*. Sauvageau also claimed to have found intercellular protoplasm in roots of *Naias major*. Kny examined a number of water plants and says: "In no case was I successful in observing living protoplasm (whether with or without nuclei or chromatophores) as a lining in the young or full grown air spaces except when its origin from the surrounding cells was in the highest degree probable. Even in the most advantageous covered preparations, in which the protoplasm within the cells adjoining the air spaces proved motile for several (in extreme cases fourteen) days, no sign of self-movement in the periphery of the air spaces was to be seen. The existence of a living extracellular plasma in the large air spaces of water plants must remain improbable until proof more convincing than at present is forthcoming."—C. R. B.

HERMANN FISCHER concludes his paper on "Der Pericykel in den freien Stengelorganen" [19] as follows:

1. In about 32 per cent. of the dicotyledons investigated a more or less perfect endodermis may be recognized marking the distinction between cortex and central cylinder. The so-called pericycle, *by its position* between the limit of the cortex and the ring of vascular bundles is allied with the pericambium of the root. Considered histologically, genetically, and as a formative region, no characters common to pericycle and pericambium can be predicated.

[18] Bot. Cent. **82**: 289–306. 1900.

[19] Jahrb. f. wiss. Bot. **35**: 1–27. 1900.

2. In monocotyledons, conifers, and 68 per cent. of the observed dicotyledons no characteristic limit of the cortex is recognizable. The ring of mechanical tissue in the monocotyledons is from no point of view allied to the pericambium.—C. R. B.

DR. F. CZAPEK describes[20] a thermostat for use in experiments involving the use of a clinostat. The apparatus consists of a rectangular iron sand bath on four legs with leveling screws. This is heated by a microburner and over it is set a copper box sheathed with asbestos and equipped with the usual thermoregulator and thermometer. The ends of the box are slit to pass over the axis of the clinostat which carries the experimental plants. These slits can be closed by slides, except a circular aperture, which can be centered about the axis of the clinostat by means of the leveling screws of the base. Temperatures may be maintained constant within a degree for several days. The apparatus may easily be modified to furnish one-sided or uniform illumination by making part or all of the box of glass. A saturated atmosphere can be obtained by using water instead of sand in the pan.—C. R. B.

CHARLES PALMER NOTT has published an account[21] of the species of *Nitophyllum* of California. The paper is more than a description of the species, for it contains a general discussion of the generic characters and of the geographical distribution. It seems that this genus of the red algæ has a general distribution throughout the oceans of the globe. About seventy species are known, ten of which occur on the west coast of North America, and eight of these are limited to California or neighboring shores. *N. corallinarum* is described as a new species. The plates are photolithographs, and show the plant forms and even the texture excellently.—J. M. C.

[20] Ber. d. deutsch. bot. Gesells. **18**: 131. 1900.

[21] Proc. Calif. Acad. Sci. III. **2**: 1–46. *pls. 1–9*. 1900.